COLORADO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERALS AND GEOLOGY

SAMPLING AND ANALYSIS PLAN
NON POINT SOURCE PROGRAM
ANIMAS RIVER TARGETING CONTINUATION PROJECT
CEMENT CREEK WATERSHED - SILVERTON MINING DISTRICT
SAN JUAN COUNTY, COLORADO

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1.0 INTRODUCTION

The Division of Minerals and Geology (DMG) of the Colorado Department of Natural Resources (CDNR), in cooperation with the U.S. Environmental Protection Agency (EPA), and Colorado Department of Public Health and Environment (CDPHE) will coordinate the Animas River Targeting continuation Project within the Clean Water Act, Section 319, Non Point Source Program (NPS) in the Cement Creek watershed, Silverton Mining District, San Juan County, Colorado. The NPS project will provide data which will enable feasibility investigations and pre-engineering evaluations in Cement Creek to identify sites that will be considered for remedial projects designed for water quality improvements to meet the goals for attaining aquatic life uses in the Basin.

Field work for this NPS project is scheduled to be conducted as a reconnaissance investigation in August 5-16, 1996, one sampling event scheduled for September 17, 1996, and three sampling events in 1997. The dates for the 1997 sampling will be determined by snowpack conditions and forecasted weather conditions. This SAP is prepared to guide field operations and to outline the analytical objectives for the NPS sampling project. This SAP will evaluate aqueous sources identified by the DMG Non-Point Source *Animas River Targeting Continuation Project/Cement Creek Component*, surface water bracketing of each site and field screening of mining waste piles (DMG, 1995).

This SAP calls for the collection of up to 75 field samples including 56 surface water samples, and 19 aqueous source samples (draining mine adits). In addition, the sampling team will provide quality assurance/quality control samples consisting of field blanks, trip blanks, rinsate blanks, duplicate samples, and triple-volume water samples for laboratory calibration purposes.

A field screening of mining waste piles will be done during the August, 1996 reconnaissance investigation. The field screening will be done to determine which waste piles should be investigated further. Up to 50 1-2 Kilogram samples will be collected from waste piles throughout the basin. There are no standard operating practices to cover this field screening. The field screening method will be developed in the field. The final method chosen will be documented and submitted to EPA. The anticipated method is as follows: A portion of the sample will be field extracted by adding 2 volume of analyte-free water to 1 volume of mine waste and filtering the water using standard soil extraction grade paper after two hours. The extract will then be tested for pH and electrical conductivity and field analyzed for alkalinity and acidity by titration using a Hach digital titrater. The remaining sample will be kept in the original ziploc bag for future analysis, if needed. The Animas River Targeting Project is being done at the direction of the Animas River Stakeholders Group (ARSG). ARSG is a collaborative effort involving a wide range of public and private interests with the mission of improving water quality and aquatic habitats in the Animas Watershed. Stakeholders include federal and state agencies, local government, the mining industry, individual land owners, environmental and citizens groups, residents, and others.

2.0 OBJECTIVES

Cement Creek has been included in the *Animas River Targeting Project*, initiated by the CDPHE Water Quality Control Division in 1991. The 1996 DMG NPS project is intended to complete feasibility investigations and pre-engineering evaluations in Cement Creek to identify sites that will be considered for remedial projects to approach aquatic life goals in the Basin. The NPS project includes sampling of surface water and aqueous mine waste source areas (DMG, 1995b).

This SAP is for water samples and non-analytical data needed to quantify contribution of metals from individual mine sources into Cement Creek. Because of the complexity of Prospect Gulch, a tributary to Cement Creek, those sampling sites are identified separately in this SAP.

This SAP is intended to fulfill the following objectives for further evaluation of the basin:

- Characterize aqueous mine sources located throughout Cement Creek through the collection and analysis of source samples.
- Characterize and evaluate mining waste sources located throughout Cement Creek through the collection and analysis of leachate water emitting from the waste piles, on an opportunistic basis, and through field screening in August, 1996.
- Evaluate the impact to surface water through the collection and analysis of surface water samples.
- Identify sites that will be considered for water quality improvement.

3.0 BACKGROUND INFORMATION

3.1 LOCATION AND SITE DESCRIPTION

The City of Silverton is situated at an elevation of 9,305 feet above mean sea level (msl). Prospect Gulch, North Fork of Cement Creek, South Fork of Cement Creek, and Minnehaha Gulch are tributaries to Cement Creek which originates about seven miles north and west of Silverton, near the San Juan County line, at approximately 13,000 feet above msl. Historic mining in the area took place throughout Cement Creek and its tributaries.

San Juan County and the City of Silverton are located in southwestern Colorado, approximately a 7 hour drive from Denver. The area can be reached by driving south on Interstate 25 to Walsenburg, then west on Highway 160 to Durango, then north on U.S.

Highway 550, taking Colorado State Highway 110 into Silverton. Follow Highway 110 through town, and turn north onto Cement Creek Canyon Road at 17th Street.

3.2 SITE HISTORY AND PREVIOUS WORK

The discovery of gold in Arrastra Gulch brought miners to the Silverton area in the early 1870's. The discovery of silver in the base-metal ores was the major factor in establishing Silverton as a permanent settlement. Between 1870 and 1890, the richer ore deposits were discovered and mined to extent possible. Not until 1890 was any serious attempt make to mine and concentrate the larger, low-grade ore bodies in the area. The North Star mine constructed a mill on Sultan Mountain (approximately 1 mile southwest of Silverton) and between 1894 and 1897; a nearby matte smelter processed up to 100 tons of ore per day (CDH, 1994a).

The Kendrick and Gelder smelter was built near the mouth of Cement Creek in 1900 and operated during the summer months until 1905. Regional low-grade ores containing gold, silver, lead and zinc were processed at 12 concentration mills in the valley, and further refined at the K&G Smelter. Approximately 5,500,000 pounds of copper matte from the upper levels of the Henrietta mine, located in Prospect Gulch, was developed at the K&G smelter. The K&G Smelter was operated by the Ross Mining and Milling Company in 1906 and 1907, chiefly for copper ores from its mines. Mining and milling slowed down circa 1905, and mines were consolidated into fewer larger operations with the facilities for milling large volumes of ore (CDH, 1994a).

The Cement Creek basin contains many historic mines. The Queen Anne Mine, Ross Basin (unnamed) Mines, Mogul Mine, South Mogul Mine, and Red and Bonita Mine are located in upper Cement Creek Basin. The Sunnyside Gold Company's Sunnyside Mine, located approximately 5.5 miles up Cement Creek near Gladstone, began operations in 1959, mining copper, lead, zinc, silver and gold. The active Gold King Mine complex is located in the North Fork of Cement Creek. The Lead Carbonate Mill is located in the Minnehaha Creek basin. The Black Hawk Mine is located in the Middle Fork, whereas the Silver Ledge Mine is located in the South Fork. Mines in Prospect Basin include the Galena Queen, Hercules, Henrietta complex, Lark, and the Joe and John's Mines. The Anglo Saxon and Gold Hub Mines are located along the mainstem of Cement Creek below its confluence with Prospect Gulch (DMG, 1995a&b).

3.2.1 Previous Investigations

A Preliminary Assessment was conducted regarding the Kendrick & Gelder Smelter by the Colorado Department of Health in 1994 (CDH, 1994a). Site Investigations and related surface water sampling was conducted at both the Sunnyside Mine at Gladstone, in Cement Creek Basin, as well as at the Mayflower Mill, located approximately 1.5 miles north of Silverton, by the Colorado Department of Health in 1984. Surface water sampling of Cement Creek, fifty feet above and below the Sunnyside Mine, above the confluence with South Fork, indicated levels of heavy metals including cadmium, lead and silver, above drinking water standards (CDH, 1984a&b).

Cement Creek is included in the *Animas River Targeting Project*, initiated by the CDPHE Water Quality Control Division in 1991. The project consists of monitoring the chemical, physical and biological health of the Upper Animas River Basin to determine what improvements to aquatic life uses might be attained. Synoptic water quality monitoring at 200 sites within the Upper Animas, Cement and Mineral Creek basins were conducted on four occasions, September, 1991, June 1992, October 1992 and July 1993. Biological assessments, conducted at selected sites in the upper basin in October, 1992, found that aquatic life is not supported in the Cement Creek basin, the Animas River above Maggie Gulch, and the mainstem and Middle Fork of Mineral Creek. Lack of aquatic life is attributable both natural and anthropogenic factors contributing to dissolved aluminum, cadmium, copper, and zinc present in the Animas River basin in concentrations both acutely and chronically to most forms of aquatic life. Additionally, ferric iron, coming from Cement Creek and Mineral Creek forms a deposit on the Cement Creek streambed as well as in the Animas river between Cement Creek and Elk Creek, further inhibiting aquatic life (CDPHE, 1994).

During September-October, 1994, the U.S. Geological Survey, in cooperation with the Colorado Department of Public Health and Environment analyzed drainage from natural springs for comparison with mine drainage, in Ohio and Topeka Gulches, tributaries to Cement Creek. Mines had similar concentrations and loads of dissolved metals compared to naturally occurring springs and streams in Topeka Gulch (USGS, 1995).

Concurrent water quality monitoring will be done by Sunnyside Gold Corporation (SGC), the U.S. Geological Survey (USGS), U.S. Bureau of Reclamation (USBOR), and Colorado River Watch. SGC plans to bulkhead the American and Terry Tunnels to stop metal laden water from exiting the tunnels. In order to offset any potential degradation of water quality in Cement Creek, SGC and CDPHE have agreed to a plan that includes injecting alkaline water into the mine pool, mitigating at least six mine sites throughout the upper Animas Basin to reduce metal loading to the Animas River below Silverton. SGC will also treat a portion of the flow in Cement Creek from above the American Tunnel until all mitigation work is completed in order to create a water quality "cushion" for the Animas River Below Silverton. This work has been ordered by the District Court in a Consent Decree in return for the Water quality Control Division not permitting any seeps or springs that may result from mine closure activities.

In order to evaluate the effects of bulkheading the American and Terry Tunnels, SGC has been monitoring both natural seeps and mine drainages in the Cement Creek and Animas River drainages in advance of closing the valves of the bulkheads. SGC will continue monitoring the seeps and springs and Cement Creek above and below the American Tunnel treatment plant monthly. SGC will also monitor receiving streams above and below four of the six mitigation project sites during high flow and low flow periods prior to and for two years following remediation.

The USGS plans to conduct a dilution tracer experiment to quantify the groundwater and surface water quantity and quality inputs to Cement Creek from above the American Tunnel to the Cement Creek stream gage at Silverton. This work will be coordinated with the sampling described in this SAP.

The Colorado River Watch Program conducted by the Silverton Public Schools will continue to monitor water quality at the Cement Creek, Mineral Creek and Animas River gauges on a regular basis. The USBOR will monitor the same sites on an alternating schedule with SGC.

3.3 SITE GEOLOGY, HYDROGEOLOGY, AND HYDROLOGY

3.3.1 Geology

The Cement Creek Basin is located on Quaternary, glacial moraine deposits, of the Pinedale and Bull Lake Glaciation. These surface deposits overlie Tertiary, andesitic lavas of the Eureka Rhyolite.

The area underwent relatively continuous sedimentary deposition in the Paleozoic, from Cambrian to Permian. Deposition continued into the Mesozoic, with apparent regularity over most of the area. Near the end of the Mesozoic, the area was uplifted, and subjected to deep erosion. Sedimentary rocks are preserved, and exposed primarily to the southwest of Silverton. Beginning in the late Cretaceous to early Tertiary, the first of many periods of intrusive and volcanic activity began which characterizes the Tertiary history of the San Juan Mountains. The dominant feature in the area is the mid-Tertiary, Silverton Caldera. Fractures related to the subsidence of the caldera, control ore deposition in many of the Silverton mining areas. Intrusive activity, and faulting (followed by the formation of the major ore bodies) continued in the later Tertiary (Miocene or later).

Metalliferous deposits are of three general types: veins, replacement bodies, and disseminated. Veins are of the complex-sulfide type. Pyrite ($FeS2$), galena (PbS), sphalerite (ZnS) and chalcopyrite ($CuFeS2$), occurring in a gangue of quartz, and minor calcite are the most abundant vein materials. Gold and argentiferous galena have accounted for most of the value. Tetrahedrite ($(CuFe)12Sb4S13$) is locally abundant and often carries considerable silver. Visible free gold in very rare in this area.

Surficial materials of Pleistocene, and Recent age can be divided into four groups: glacial till (the most extensive), alluvium, talus, and landslide material. Glacial moraine deposits are typified by silty, clayey gravels, with cobbles and boulders.

Soils associated with the Animas River are shallow and vary from well to poorly drained. The soils have slow infiltration rates when thoroughly wet, and slow rates of water transmission (CDPHE, 1994a).

3.3.2 Hydrogeology

Shallow, unconfined aquifers in the area are alluvial, associated with Cement Creek and the Animas River, and glacial moraine deposits. These deposits overlie bedrock, composed of Tertiary, andesitic lavas, related to the formation of the Silverton Caldera. There is some indication of the depth to ground water for the bedrock aquifers has been modified by drainage tunnels and adits constructed to de-water the mines (CDH, 1994a).

Three wells have been identified as being used for household or domestic purposes in the

Cement Creek Basin: one at the mouth of South Fork, one at the head of South Fork and one at the mouth of Cement Creek; well depths and water levels are not recorded. Three wells on the mainstem of the Animas River below Howardsville, approximately 3 miles northeast of Silverton, have been identified as being used for household or domestic purposes. One was reported to be drilled to a depth of 10 feet. Two monitoring wells were drilled by the City of Silverton, located along the Animas River within city limits, are reported having depths to water of 20 and 40 feet. Two wells are located along Mineral Creek, above its confluence with the Animas River; the depths to water are recorded at 12 and 35 feet (Colorado Division of Water Resources, 1996). The shallow depths to water of the wells located along the Animas River and Mineral Creek indicate that the wells access the alluvial aquifer.

Groundwater will not be sampled, as it is outside the scope of the NPS Sampling Project objectives.

3.3.3 Hydrology

Regionally, the site is located within the San Juan River Basin, located along the tributaries and the mainstem of Cement Creek. Cement Creek is a tributary to the Animas River, located within the Silverton caldera, an extensively mineralized area that has been mined for base and precious metals since the late 1800's (CDPHE, 1995b). Cement Creek has extensive stream sediment staining by iron oxides to the confluence with the Animas River; the Animas River does not exhibit staining at the confluence. Cement Creek is classified as a Recreation 2 water body by the CDPHE Water Quality Control Commission (CDH, 1994b).

Biological sampling of fish and macrobenthos conducted by the CDPHE between 1991 and 1993 determined that fisheries exist in the Animas River between Maggie Gulch and Cement Creek; however, aquatic life is not supported in either the Animas River above Maggie Creek or in Cement Creek (CDPHE, 1994).

3.4 PRELIMINARY PATHWAY ANALYSIS

3.4.1 Source Characterization

Byproducts of underground metal mining, commonly referred to as mine waste, generally fall into three categories: waste rock, generated from the extraction of ore; drainage of groundwater from mine workings; and mill tailing, i.e., remnants of crushed ore from which minerals of interest have been processed. Mine wastes may generate two major types of pollutants: acid drainage, with corresponding high concentrations of heavy metals; and metal-laden sediments derived from erosion of waste rock and/or tailings piles. Mine drainage composition is a function of ore deposit geology, climate, and mining methods used. Factors controlling pH and dissolved metal concentration include the acid buffering capacity of the country rock and the abundance of acid-generating sulfide minerals (CDPHE, 1995a).

The DMG NPS sampling effort will collect and analyze 19 aqueous sources i.e., draining mine adits, found throughout the basins:

3.4.1.1 Cement Creek Sources.

Preliminary reconnaissance by the Division of Minerals and Geology in 1992-1995 has identified the following important potential mine sites:

Queen Anne Mine
The Queen Anne is a draining mine adit (Site # SO-1) located in the upper Cement Creek Basin, immediately west of a tributary flowing into Cement Creek (Site # CC-SW-02). The mine drainage infiltrates into and emerges from the base of the adjacent mine waste pile (DMG, 1995a).

Unnamed Mine in Ross Basin
This unnamed mine consists of a draining adit (Site # SO-3) and adjacent waste pile located directly south of the Queen Anne Mine in lower Ross Basin above the confluence of the tributary receiving drainage from the Queen Anne Mine. In July of 1993, acid drainage with a measured pH of 3.7 was observed flowing from the base of the waste rock pile. As the adit was covered with snow, the source of the drainage could not be verified. Iron precipitate was observed in the drainage channel and a white precipitate in the stream below the confluence with the drainage (DMG, 1995a).

Mogul Mine
The Mogul Mine consists of a draining adit (Site # SO-5) and adjacent waste rock pile. The pH of the mine drainage was measured at 3.1 and observed to be draining an estimated 5 gallons per minute, in July, 1993; evidence indicates that higher flows commonly occur. The drainage flows over the surface of the waste rock pile for approximately 75 feet, percolating into the waste rock pile, then resurfaces at the toe of the waste pile in several locations (DMG, 1995a).

South Mogul Mine
The South Mogul Mine consists of a draining mine adit (Site # SO-6) and adjacent waste rock pile, are located south of the Mogul Mine, on the east side of Cement Creek (DMG, 1995b).

Red and Bonita Mine
The Red and Bonita Mine consists of a draining mine adit (Site # SO-8) and adjacent waste rock pile, on the east side of Cement Creek, above the confluence with the North Fork (DMG, 1995b).

Black Hawk Mine
The Black Hawk Mine consists of a draining mine adit (Site # SO-12) and adjacent waste rock pile on the north side of the Middle Fork of Cement Creek.

Gold King Mine
The Gold King Mine site consists of two drainage adits in the North Fork of Cement Creek. This site is a permitted mining operation.

Silver Ledge Mine
The Silver Ledge Mine consists of a draining mine adit (Site # SO-13) and adjacent waster rock pile on the north side of the South Fork of Cement Creek.

Gold Hub Mine
The Gold Hub Mine consists of a draining mine adit (Site # SO-14) and adjacent waste rock pile, located along the eastern slope of the mainstem of Cement Creek, below the confluence with Illinois Gulch.

Anglo Saxon Mine
The Anglo Saxon Mine, located along the western slope of the mainstem of Cement Creek below the confluence of Ohio Gulch, consists of a draining mine adit (Site # SO-16) flowing over an adjacent waste rock pile, into a settling pond, then into Cement Creek. A perennial spring emanates from the toe of the waste pile (DMG, 1995b).

Big Colorado Mine
The Big Colorado mine consists of a draining mine adit (Site # SO-17) and adjacent waste rock pile on the south side of the South Fork of Cement Creek.

Unknown Mine South of Prospect Gulch
This mine site is reported to be a crosscut tunnel driven toward the Henrietta Mine in Prospect Gulch. The site consists of a draining mine (Site # SO-18) and adjacent waste rock pile on the west side of Cement Creek on the access road to Georgia Gulch.

Unknown Mine South of Georgia Gulch
this site consists of a draining mine adit (Site # SO-19) and adjacent waste rock pile west of a secondary road between Georgia Gulch and Fairview Gulch.

Kansas City Mines
The Kansas City mines consists of 4 mine adits and adjacent waste rock piles in upper Georgia Gulch. three of the mine adits have been observed to drain (Sites SO-20, SO-21, and SO-22).

Unknown Mine in Porcupine Gulch

This mine site consists of a draining mine adit (Site # SO-23) and adjacent waste rock pile. The mine site is located approximately 150 yards west of the Anglo Saxon mine on the north side of Porcupine Gulch.

Unknown Mine in Dry Gulch

This mine site consists of a draining mine adit (Site # SO-24) and adjacent waste rock pile. The mine is located on the western side of Dry Gulch approximately 50 yards above the Prospect Gulch access road crossing of Dry Gulch.

3.4.1.2 Prospect Gulch Sources

Galena Queen Mine

The Galena Queen mine consists of a series of three waste rock piles through which upper tributaries forming Prospect Gulch flow (DMG, 1995a).

Hercules Mine

The Hercules Mine consists of a series of three mine waste piles located in, and immediately adjacent to, upper tributaries forming Prospect Gulch. A shaft was observed in the waste pile with swirling water at a depth of 50 feet below the surface. Overland flow above the mine waste was observed to percolate through the piles, denuding the vegetation below (DMG, 1995a).

Henrietta Mine

The Henrietta Mine complex consists of one draining mine adit (SO-04) and an extensive mine waste pile, located along the southern bank of Prospect Gulch. The mine drainage was observed to infiltrate the waste rock, emerging from the toe of such piles into Prospect Gulch (DMG, 1995a).

Lark Mine

The Lark Mine consists of one intermittently draining mine adit and adjacent mine waste pile located along the northern bank of Prospect Gulch. Springs located above the waste rock were observed to infiltrate the waste pile, emerging from its toe into Prospect Gulch (DMG, 1995a).

Joe and John's Mine

Joe and John's Mine consists of draining mine adit (SO-06) and adjacent mine waste pile, located above the road on the northern slope of Prospect Gulch (DMG, 1995b).

3.4.2 Ground Water Pathway Analysis

The nearest ground water wells identified for use as domestic or household purposes use are located at the head and mouth of the South Fork of Cement Creek, and at the mouth of Cement Creek. These wells appear to be installed into the surficial alluvial aquifer of the various tributaries of the Animas River (Colorado Division of Water Resources, 1996). Groundwater wells will be sampled by CDPHE-HMWMD.

3.4.3 Surface Water Pathway Analysis

Previous studies have documented the release of metal contaminants to surface water in Cement Creek, Prospect Gulch and the mainstem of the Animas River (CDPHE, 1994). Primary targets within 15 downstream miles include fisheries, and wetlands. Previous studies have included a limited number of analytes and no sediment analytical data is available. The City of Silverton obtains its municipal drinking-water from Boulder Creek, upstream of the SGC Mine tailings (CDPHE, 1995b).

It has been reported that Cement Creek is devoid of fish and minimal aquatic life was found in the Animas River from below the confluence of Cement Creek to Elk Creek, approximately 6 miles south of Silverton, due to metals loading and cementation of stream substrate associated with both natural mineralization as well as historic mining activities (CDH, 1994).

An evaluation of segments of the Animas River Basin by the Colorado WQCD for a rule making hearing states that "significant metal loading occurs in the three watersheds that converge near Silverton: the Animas headwaters, Cement Creek and Mineral Creek. The mainstem of the Animas above Elk Creek, Mineral Creek from it headwaters to the confluence with south Mineral Creek, and the entire Cement Creek watershed lack the aquatic life classification and water quality standards for metals. Cement Creek has the poorest water of the three watersheds. Low pH water throughout the watershed, in the range of 3.0 to 5.5, mobilizes aluminum, cadmium, copper, iron, manganese, and zinc. Aluminum, copper and zinc are readily precipitated, forming bottom deposits as the stream pH increases. Most of the zinc loading is from the upper part of the watershed, but high concentrations of zinc are found throughout the Cement Creek" (CDH, 1994b).
The WQCD recognized that achievement of full aquatic life uses thought the basin is probably not possible. However, opportunities to reduce metal loads within the watersheds to improve water quality for aquatic life in the mainstem of the Animas River between Maggie Gulch and Elk Creek is reflected in the Division's water quality recommendations for the 1994 triennial review (CDH, 1994b).

Surface water samples will be collected at up to 56 locations and analyzed for total and dissolved metals, as specified in Table V. Tables I and II provide the sample type, identification number, location and rationale for samples collected in Cement Creek and Prospect Gulch, respectively. Figures 1-4 illustrate sample locations.

Federally listed endangered species that could occur at, or visit, the area include the Northern Gos Hawk (*Accipiter gentilis*) and the Boreal Toad (*Bufo borealis*) (USFWS, 1995).

3.4.4 Soil Exposure Pathway

There are no persons living on-site or within 200 feet of any of the identified sources. The sources located along Cement Creek and Prospect Gulch are greater than 1-mile from the nearest residents. The risk posed to human health or the environment by the on-site pathway for the sources identified is considered to be minimal.

4.0 FIELD PROCEDURES

4.1 CONCEPT OF OPERATIONS

4.1.1 Schedule

The sampling events are scheduled for September 17, 1996, January, 1997, April, 1997, and June or July, 1997. The January, 1997 and April, 1997 sampling will only include surface water sampling sites CC-13, CC-16, CC-20, CC-23, CC-24, CC-26, and PG-19.

The June or July, 1997 sampling will include all the Prospect Gulch sampling sites and all aqueous source sites. A site reconnaissance trip will be performed in August, 1996 to verify sample locations, obtain site access, to screen waste piles and to facilitate sampling logistics.

4.1.2 Safety

The NPS Sampling project will be conducted by several DMG teams which will consist of 2-4 persons and will include a Site Safety Officer. Protective clothing and powderless gloves will be worn during all sample collection. It is expected that most site-related activities can be accomplished in Level D personal protective equipment (PPE).. PPE will be upgraded to Level C if site conditions warrant. If Level B becomes necessary, the field team will temporarily cease operations until the Site Safety Officer can arrange for this type of protection.

4.1.3 Site Access and Logistics

Access to all sample locations will be coordinated by the project manager. Efforts will be made to obtain consensual access through the various property owners for all sample locations.

4.2 SAMPLE LOCATIONS

This SAP calls for the collection of up to 75 field samples including: 19 aqueous source samples (draining mine adits) and 56 aqueous surface water samples. In addition, the sampling team will provide up to 12 quality assurance/quality control samples consisting of field blanks, duplicates, and triple-volume water samples for laboratory calibration purposes (Tables III and IV).

Tables I and II describe the sample type, identification number, location, and rationale for each sample for the Cement Creek and Prospect Gulch basins, respectively. Figures 1 through 4 illustrate the sample locations.

4.3 SAMPLING METHODS

All samples will be collected in accordance with protocols identified in the *QAPP for the Colorado Nonpoint Source Monitoring Program (9-8-94)*. Measures will be taken to minimize the amount of in-field equipment decontamination required for the sampling event. Sampling equipment will be decontaminated prior to the sample event. Equipment which will be reused will be decontaminated in the field. Decontamination will be achieved by washing with a non-phosphate detergent and triple rinsing with deionized water.

Water samples for dissolved metals analysis will be field filtered with a 0.45 micron filter into the sample container and then preserved at a pH of 2 with nitric acid. Water samples for total metals analysis will be preserved at a pH of 2 with nitric acid. In-field measurements of pH, conductivity, and temperature, and flow will be made for all water samples according to the QAPP.

Where possible surface water samples will be collected directly into the sample containers. Where the sample cannot be directly collected in the sample bottle, a clean 1-liter wide-mouth bottle will be used for collection. Sampling will progress from a downstream location to an upstream location to eliminate sediment disturbance in subsequent samples. Surface water samples will be collected by immersing the sample bottle several inches beneath the water surface with the mouth of the sample bottle facing upstream. A separate surface sample may be collected if immiscible fluids are observed. To collect such a sample, the sample container will be inverted, lowered to the approximate sample depth and held at about a 45-degree angle with the mouth of the bottle facing downstream.

If surface water samples cannot be collected directly into the sample container, a decontaminated 1-liter bottle will be used to collect the sample. Care will be taken to avoid excessive agitation when transferring samples to the sample containers.

Flow measurements will be obtained for all surface water sample locations except for samples located at the mouth of Cement Creek and in the Animas River, where flow will be determined based upon a reading from the gauging station.

4.4 CONTROL OF CONTAMINATED MATERIALS

The sampling team will dispose of all wastes produced during the investigation in accordance with EPA document 540-G-91-009 entitled *Management of Investigation-Derived Wastes During Site Inspections*. Disposable sampling equipment, rubber gloves, and protective outerwear will be decontaminated, bagged, removed from the Site and disposed of as a non-hazardous solid waste. Detergent solutions for decontamination will be collected in polyethylene bottles and disposed of at the field laboratory in Silverton. Rinsate water will be allowed to flow onto the ground at the site.

4.5 ANALYTICAL PARAMETERS

Tables I and II describe sample identification, type, location, and rationale for each sample from Cement Creek and Prospect Gulch basins, respectively. Tables III and IV presents the Sampling Plan Check List specifying analyses to be performed on each sample from Cement Creek and Prospect Gulch basins, respectively.

Analysis will be performed EPA's Technical and Management Services-Laboratory. Samples will be analyzed for the inorganic Target Compound List (TCL) analytes contained in Table V.

4.6 NON-ANALYTICAL DATA COLLECTION

The following non-sampling observations and data will be obtained:

- Satellite Coordinate Lat/Long determination for all sample locations using a hand-held GPS unit.

- Stream flow measurements for all surface water sample locations on Upper Cement Creek and Prospect Gulch using current meters and cutthroat flumes. Animas River and lower Cement Creek flow data will be obtained from the closest gauging stations.

- Verify and photodocument extent of wetlands for surface water pathway.

5.0 FIELD QUALITY CONTROL/QUALITY ASSURANCE

The Quality Assurance Project Plan for the Colorado Nonpoint Source Monitoring Program (QAPP) dated September 8, 1994 and approved by EPA on June 25, 1996 will be adhered to. Sample bottles will be purchased commercially, will meet EPA specifications, and will be part of the quality control program. The sample containers to be used for this NPS Sampling project will be 250 milliliter polyethylene bottles for surface water and aqueous source samples (total recoverable metals, dissolved metals, and Lab Group C analytes).

The following types of samples will be provided for QA/QC purposes:

Rinsate blanks will be collected in the field using analyte-free water from decontaminated equipment as a check for decontamination procedures. One rinsate blank will be collected for each day sampling equipment is decontaminated in the field (at the rate of one per 20 samples).

Field blanks will be prepared for each day of sampling at the rate of one per 20 samples.

One duplicate water matrix water sample will be collected per 20 samples shipped to determine accuracy and precision in laboratory analytical procedures and sample collection procedures.

One triple volume sample per 20 water samples will be collected to provide matrix spike and matrix spike duplicate (MS/MSD) to allow for a check of laboratory quality control procedures.

Rinsate blanks, field blanks, and duplicates will be submitted with separate sample ID's as blind samples. The triple volume samples will be designated on the Chain of Custody form as being for Lab QC purposes.

6.0 CHAIN OF CUSTODY

All samples will be handled in strict accordance with chain of custody protocol prescribed by the *NEIC Procedures Manual for the Evidence Audit of Enforcement Investigation by Contractor Evidence Audit Teams*, April 1984 (EPA-300/9-81 003R). Documentation of sample storage and shipment will be included as part of the chain-of-custody procedures.

7.0 REPORTING

Records will be kept of actual sample locations and sample points will be accurately located on topographic maps using the measured Latitude/longitude. Procedures will provide documentation of changes in sample locations as they occur in the field due to unanticipated site conditions. Sample locations and sample collection procedures will be documented through the keeping of a field notebook and photographs. Following completion of all field activities, a Sample Activities Report (SAR) will be prepared to document sampling activities and to precisely identify sample locations. Upon receipt of analytical data, Results will be compiled in a report, and used for identifying which mine sites will be considered for reclamation to improve water quality in the basin.

8.0 REFERENCES

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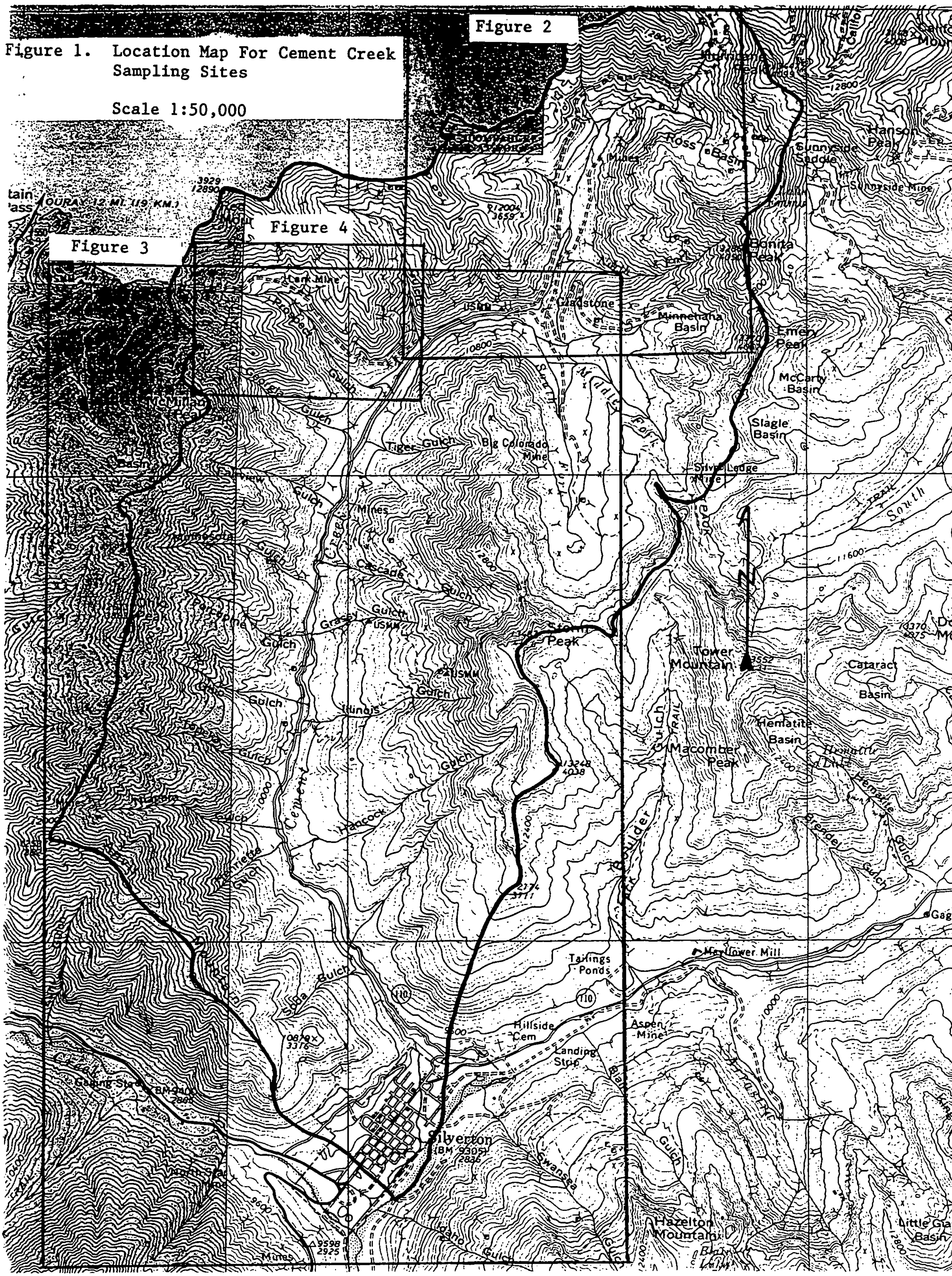
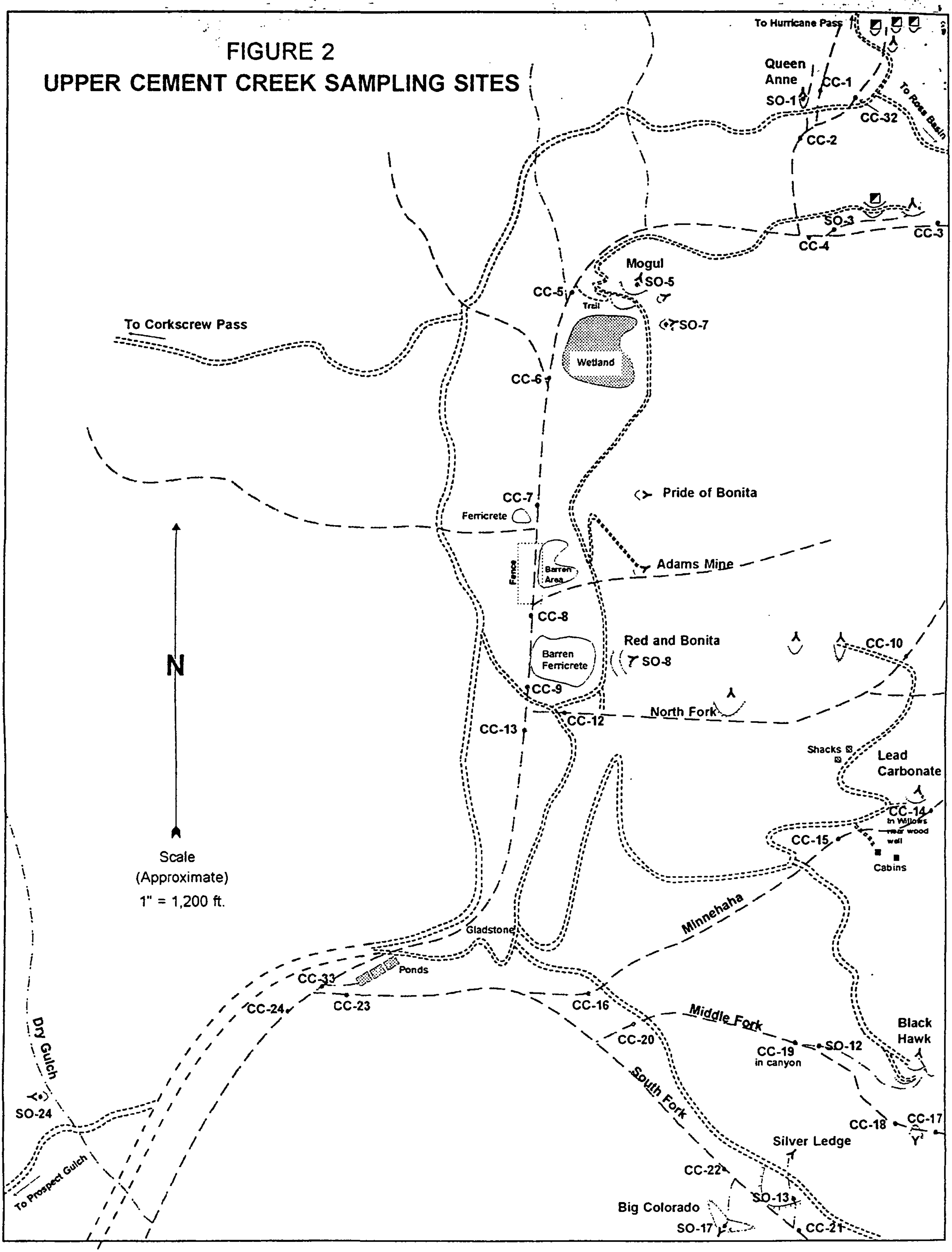


Figure 1. Location Map For Cement Creek Sampling Sites

Scale 1:50,000

FIGURE 2
UPPER CEMENT CREEK SAMPLING SITES



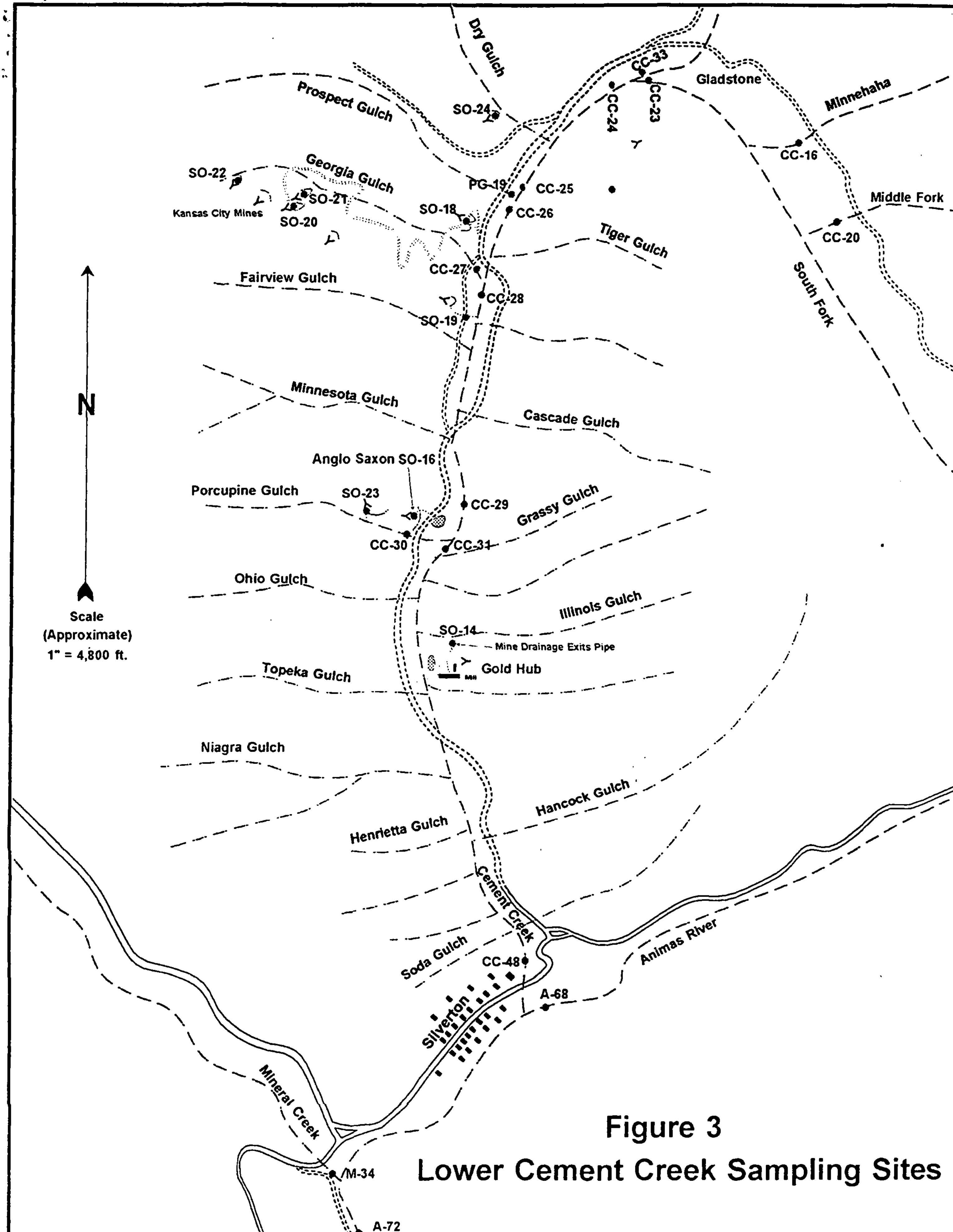


Figure 3
Lower Cement Creek Sampling Sites

FIGURE 4
PROSPECT GULCH SAMPLING SITES

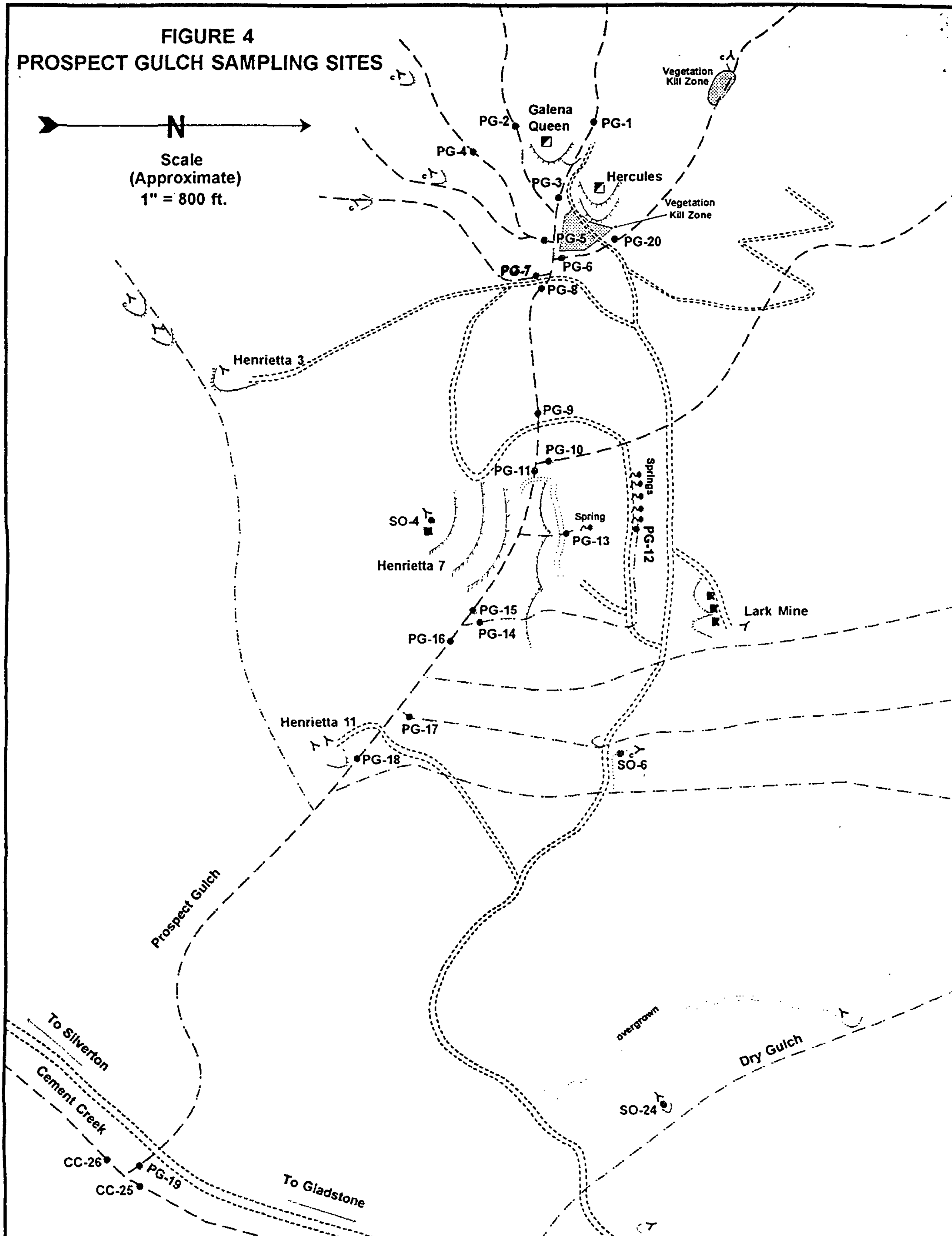


Table 1: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples	CC-1	Cement Creek upstream of the Queen Anne Mine	To determine background surface water quality for Cement Creek.	1. Note observations of stream conditions such as flow rate, color, turbidity, and odor.
	CC-2	Cement Creek below the discharge from the Queen Anne Mine drainage and rock pile.	To assess potential contribution of substances from the Queen anne Mine and waste pile.	2. Not unusual or poor vegetative growth along surface water bodies.
	CC-3	Ross Basin tributary (Upper Cement Creek) upstream of the unnamed draining mine & waste pile.	To determine background surface water quality for Cement Creek.	3. Note the presence or absence of fish and wildlife in the area.
	CC-4	Ross Basin tributary downstream of the unnamed draining mine and waste pile.	To assess potential contribution of substances from the Ross Basin unnamed draining mine and waste pile.	4. Note any observations of recreational fishing.
	CC-5	Cement Creek upstream of the Mogul and South Mogul mine drainages and waste piles.	To determine ambient surface water quality in the Cement Creek immediately upstream of the Mogule and South Mogul mines.	5. Note the presence of tailings or other potential sources within the surface water.
	CC-6	Cement Creek downstream of the Mogul and South Mogul mine drainages and waste piles.	To assess potential contribution of substances from the Mogul and South Mogul mine drainages and mine waste piles to Cement Creek at the probable point of entry.	6. Note locations and extent of wetlands and sensitive environments.
	CC-7	Cement Creek above Corkscrew gulch, above small denuded area.	To determine surface water quality in Cement Creek prior to contribution of the small denuded areas.	7. Take photographs as necessary to supplement documentation of observations.
	CC-8	Cement Creek below the confluence of Corkscrew Gulch and the small denuded area, and above the Red & Bonita Mine.	To determine surface water quality in Cement Creek below the small denuded area and upstream of the Red & Bonita Mine.	
	CC-9	Cement Creek below the Red & Bonita Mine drainage and waste pile.	To assess potential contribution of substances from the Red & Bonita Mine drainage and waste pile.	
	CC-10	North Fork above the Gold King Mine complex.	To determine background surface water quality in the North Fork.	
	CC-11	DELETED	DELETED	
	CC-12	North Fork above the confluence with Cement Creek.	To determine surface water quality in the North Fork before its confluence with Cement Creek.	
	CC-13	Cement Creek below the confluence with North Fork, above the confluence with South Fork.	To determine surface water quality in Cement Creek below its confluence with North Fork.	
	CC-14	Minnehaha Creek above the Lead Carbonate Mill waste pile	To determine background surface water quality in Minnehaha Creek.	
	CC-15	Minnehaha Creek below the Lead Carbonate Mill waste pile.	To assess potential contribution of substances from the Lead Carbonate Mill waste pile to Minnehaha Creek.	

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples	CC-16	Minnehaha Creek above its confluence with South Fork.	To determine surface water quality in Minnehaha Creek prior to its confluence with South Fork.	
	CC-17	Middle Fork above the unnamed in-stream waste pile.	To determine background surface water quality in the Middle Fork.	
	CC-18	Middle Fork below the unnamed in-stream waste pile.	To assess potential contribution of substances from the unnamed in-stream waste pile to Middle Fork at the probable point of entry.	
	CC-19	Middle Fork below the Black Hawk Mine drainage and waste pile.	To assess the potential contribution of substances from the Black Hawk mine drainage and waste pile to the Middle Fork.	
	CC-20	Middle Fork above its confluence with South Fork.	To determine surface water quality in the Middle fork below combined mine waste sources.	
	CC-21	South Fork above the Silver Ledge Mine and Big Colorado drainage and waste pile.	To determine background surface water quality of the South Fork.	
	CC-22	South Fork below the Silver Ledge Mine and Big Colorado drainage and waste pile.	To assess potential contribution of substances from the Big Colorado and Silver Ledge mine drainage and waste pile to South Fork at the probable point of entry.	
	CC-23	South Fork abovre its confluence with Cement Creek.	To assess potential contributions of substances from South Fork to Cement Creek.	
	CC-24	Cement Creek below the confluence with South Fork.	To determine surface water quality in Cement Creek below the confluence with South Fork.	
	CC-25	Cement Creek above its confluence with Prospect Gulch.	To determine surface water quality of Cement Creek above its confluence with Prospect Gulch.	
	CC-26	Cement Creek below its confluence with Prospect Gulch.	To determine surface water quality of Cement Creek below its confluence with Prospect Gulch.	
	CC-27	Georgia Gulch above its confluence with Cement Creek.	To determine surface water quality of Georgia Gulch above its confluence with Cement Creek.	
	CC-28	Cement Creek below its confluence with Georgia Gulch.	To determine surface water quality of Cement Creek below its confluence with Georgia Gulch.	
	CC-29	Cement Creek above its confluence with Porcupine Gulch.	To determine surface water quality of Cement Creek above its confluence with Porcupine Gulch.	
	CC-30	Porcupine Gulch above its confluence with Cement Creek.	to assess potential contribution of substances from mine drainage and waste piles to Porcupine Gulch.	
	CC-31	Cement Creek below the confluence with Porcupine Gulch.	To determine surface water quality of Cement Creek below its confluence with Porcupine Gulch.	

Table 1: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples	CC-32	Cement Creek tributary above Queen Anne Mine and below a series of waste rock piles.	To determine the potential contribution of substances from waste rock piles above Queen Anne Mine.	
	CC-33	Animas River above the confluence with Cement Creek.	To determine surface water quality of the Animas River above its confluence with Cement Creek.	
	M-34	Mineral Creek above confluence with the Animas River.	To determine ambient water quality in Mineral Creek above the confluence with the Animas River.	
	CC-48	Cement Creek above its confluence with the Animas River.	To determine surface water quality of Cement Creek above its confluence with the Animas River.	
	CC-A-68	Animas River above the confluence with Cement Creek.	To determine surface water quality of the animas River above its confluence with Cement Creek.	
	A-72	Animas River below the confluence of Mineral Creek.	To assess potential contribution of substances from all sources.	
Aqueous Source Samples	SO-01	Queen Anne Mine drainage.	Mine drainage source characterization.	
	SO-03	Ross Basin unnamed mine drainge.		
	SO-05	Mogul Mine drainage.		
	SO-07	South Mogul Mine drainage.		
	SO-08	Red & Bonita Mine drainage.		
	SO-12	Black Hawk Mine drainage.		
	SO-13	Silver Ledge Mine drainage.		
	SO-14	Gold Hub Mine drainage.		
	SO-16	Anglo Saxon Mine drainage.		
	SO-17	Big Colorado Mine drainage.		
	SO-18	Unknown mine drainage south of Prospect Gulch.		
	SO-19	Unknown mine drainage south of Georgia Gulch.		
	SO-20	Kansas City Mine #2 drainage.		
	SO-21	Kansas City Mine #1 drainage.		
	SO-22	Kansas City Mine #4 drainage.		
	SO-23	Unknown mine drainage in Porcupine Gulch.		
	SO-24	Unknown mine drainage in Dry Gulch.		

Table 1: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Quality Assurance Quality Control	CC-34	Duplicate of CC-6	Quality control sample to assess accuracy.	
	CC-35	Duplicate of CC-16		
	CC-36	Field blank for Day 1 sampling.	Quality control sample to assess potential field contamination.	
	CC-37	Field blank for Day 2 sampling.		
	CC-38	Rinsate blank for Day 1 sampling.	Quality control to assess field decontamination procedures.	
	CC-39	Rinsate blank for Day 2 sampling.		

Table II: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASN
PROPOSED PROSPECT GULCH SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples	PG-1	Prospect Gulch upstream of the Galena Queen Mine waste pile.	To determine background surface water quality for Prospect Gulch.	1. Note observations of stream conditions such as flow rate, color, turbidity, and odor.
	PG-2	Prospect Gulch upstream of the Galena Queen Mine waste pile.	To determine background surface water quality for Prospect Gulch.	2. Not unusual or poor vegetative growth along surface water bodies.
	PG-3	Prospect Gulch below the Galena Queen Mine.	To assess potential contribution of substances from the Galena Queen Mine waste.	3. Note the presence or absence of fish and wildlife in the area.
	PG-4	Tributary to Prospect Gulch.	To determine background surface water contributions to Prospect Gulch.	4. Note any observations of recreational fishing.
	PG-5	Tributary below confluence with acid rock drainage.	To assess potential contribution of substances from the tributary with ARD to Prospect Gulch.	5. Note the presence of tailings or other potential sources within the surface water.
	PG-6	Tributary with Hercules Mine waste located therein.	To assess potential contribution of substances from the Hercules Mine waste pile to Prospect Gulch.	6. Note locations and extent of wetlands and sensitive environments.
	PG-7	Tributary with acid rock drainage.	To assess potential contribution of substances from the tributary with ARD to Prospect Gulch.	7. Take photographs as necessary to supplement documentation of observations.
	PG-8	Prospect gulch below tributaries with mine wste and ARD.	To assess potential contribution of substances from upper basin mine workings.	
	PG-9	Prospect Gulch below "mineralized canyon" and above the Henrietta Mine.	To assess potential contribution of substances from the minralized canyon and to determine ambient surface water quality in Prospect Gulch above the Henrietta Mine.	
	PG-10	Mineralized tributary above the Henrietta (level 7) mine complex.	To assess background contribution of a naturally mineralized tributary to Prospect Gulch.	
	PG-11	Prospect Gulch above the Henrietta Mine 7 complex.	To determine surface water quality in Prospect Gulch upstream of the Henrietta Mine drainage and waste pile.	
	PG-12	Perennial Springs upstream of the Henrietta Mine 7 waste pile.	To assess potential contribution of substances from naturally occurring springs to Prospect Gulch.	
	PG-13	Springs above the Henrietta 7 Mine waste pile.	To determine quality of spring water prior to its infiltrating the Henrietta 7 Mine waste pile.	
	PG-14	Springs PG-12 after percolating through the Henrietta Mine waste pile.	To assess potential contribution of substances from the Henrietta 7 Mine waste pile to springs flowing into Prospect Gulch.	
	PG-15	Prospect Gulch below the Henrietta 7 Mine complex, above the probable point of entry of the Henrietta Mine waste pile springs.	To determine surface water quality in Prospect Gulch downstream of the Henrietta Mine complex.	

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Date
Surface Water Samples	PG-16	Prospect Gulch below the Henrietta Mine waste pile springs.	To determine surface water quality in Prospect Gulch below the probable point of entry of the Henrietta Mine waste pile springs.	
	PG-17	Tributaries from the Upper Joe and Johns Mine.	To assess potential contribution of substances from the Upper Joe and Johns Mine to Prospect Gulch at the probable point of entry.	
	PG-18	Prospect Gulch below Joe and John's Mine.	To assess the potential contribution of substances from Joe and John's Mine drainage and waste pile to Prospect Gulch.	
	PG-19	Prospect Gulch above confluence with Cement Creek.	To determine surface water quality in Prospect Gulch below combined mine waste sources before its confluence with Cement Creek.	
	PG-20	Below unknown mine with waste rock in tributary.	To determine the potential contribution of substances from the unknown mine and prior to contrbutions from the Hercules mine waste pile.	
Aqueous Source Characterization Samples	SO-04	Henrietta 7 Mine drainage.	Aqueous Source Characterization	
	SO-06	Joe and John's mine drainage		
Quality Assurance Quality Control Samples	PG-21	Duplicate of PG-18	Quality control sample to assess accuracy and precision.	
	PG-22	Field blank for Day 1 sampling.	Quality control sample to assess potential field contamination.	
	PG-23	Field blank for Day 2 sampling.		
	PG-24	Rinsate blank for Day 1 sampling.	Quality control to assess field decontamination procedures.	
	PG-25	Rinsate blank for Day 2 sampling.		

TABLE III: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Upper Cement Creek Basin and the Mainstem of Cement Creek

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup	Spike	Blank
CC-1	water	X	X	X	X	X	X	X			
CC-2	water	X	X	X	X	X	X	X			
CC-3	water	X	X	X	X	X	X	X			
CC-4	water	X	X	X	X	X	X	X			
CC-5	water	X	X	X	X	X	X	X			
CC-6	water	X	X	X	X	X	X	X		3x volume	
CC-7	water	X	X	X	X	X	X	X			
CC-8	water	X	X	X	X	X	X	X			
CC-9	water	X	X	X	X	X	X	X			
CC-10	water	X	X	X	X	X	X	X			
CC-12	water	X	X	X	X	X	X	X			
CC-13	water	X	X	X	X	X	X	X			
CC-14	water	X	X	X	X	X	X	X			
CC-15	water	X	X	X	X	X	X	X			
CC-16	water	X	X	X	X	X	X	X			
CC-17	water	X	X	X	X	X	X	X			
CC-18	water	X	X	X	X	X	X	X			
CC-19	water	X	X	X	X	X	X	X			
CC-20	water	X	X	X	X	X	X	X			
CC-21	water	X	X	X	X	X	X	X			
CC-22	water	X	X	X	X	X	X	X			
CC-23	water	X	X	X	X	X	X	X			

TABLE III: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Upper Cement Creek Basin and the Mainstem of Cement Creek

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup	Spike	Blank
CC-1	water	X	X	X	X	X	X	X			
CC-24	water	X	X	X	X	X	X	X			
CC-25	water	X	X	X	X	X	X	X			
CC-26	water	X	X	X	X	X	X	X			
CC-27	water	X	X	X	X	X	X	X			
CC-28	water	X	X	X	X	X	X	X			
CC-29	water	X	X	X	X	X	X	X			
CC-30	water	X	X	X	X	X	X	X			
CC-31	water	X	X	X	X	X	X	X			
CC-32	water	X	X	X	X	X	X	X			
CC-33	water	X	X	X	X	X	X	X			
CC-48	water	X	X	X	X	X	X	X			
A-68	water	X	X	X	X	X	X	X			
M-34	water	X	X	X	X	X	X	X			
A-72	water	X	X	X	X	X	X	X			
SO-01	water	X	X	X	X	X	X	X			
SO-03	water	X	X	X	X	X	X	X			
SO-05	water	X	X	X	X	X	X	X			
SO-07	water	X	X	X	X	X	X	X			
SO-08	water	X	X	X	X	X	X	X			
SO-12	water	X	X	X	X	X	X	X			
SO-13	water	X	X	X	X	X	X	X			

TABLE III: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Upper Cement Creek Basin and the Mainstem of Cement Creek

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup	Spike	Blank
CC-1	water	X	X	X	X	X	X	X			
SO-14	water	X	X	X	X	X	X	X			
SO-16	water	X	X	X	X	X	X	X			
SO-17	water	X	X	X	X	X	X	X			
SO-18	water	X	X	X	X	X	X	X			
SO-19	water	X	X	X	X	X	X	X			
SO-20	water	X	X	X	X	X	X	X			
SO-21	water	X	X	X	X	X	X	X			
SO-22	water	X	X	X	X	X	X	X			
SO-23	water	X	X	X	X	X	X	X			
SO-24	water	X	X	X	X	X	X	X			
CC-34	QA/QC water						X	X	CC-6		
CC-35	QA/QC water						X	X	CC-16		
CC-36	QA/QC water						X	X			X
CC-37	QA/QC water						X	X			X
CC-38	QA/QC water						X	X			X
CC-39	QA/QC water						X	X			X

TABLE IV: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Prospect Gulch Basin

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup.	Spike	Blank
PG-1	water	X	X	X	X	X	X	X			
PG-2	water	X	X	X	X	X	X	X			
PG-3	water	X	X	X	X	X	X	X			
PG-4	water	X	X	X	X	X	X	X			
PG-5	water	X	X	X	X	X	X	X			
PG-6	water	X	X	X	X	X	X	X		3x volume	
PG-7	water	X	X	X	X	X	X	X			
PG-8	water	X	X	X	X	X	X	X			
PG-9	water	X	X	X	X	X	X	X			
PG-10	water	X	X	X	X	X	X	X			
PG-11	water	X	X	X	X	X	X	X			
PG-12	water	X	X	X	X	X	X	X			
PG-13	water	X	X	X	X	X	X	X			
PG-14	water	X	X	X	X	X	X	X			
PG-15	water	X	X	X	X	X	X	X			
PG-16	water	X	X	X	X	X	X	X			
PG-17	water	X	X	X	X	X	X	X			
PG-18	water	X	X	X	X	X	X	X			
PG-19	water	X	X	X	X	X	X	X			
PG-20	water	X	X	X	X	X	X	X			
SO-04	water	X	X	X	X	X	X	X			
SO-06	water	X	X	X	X	X	X	X			
PG-21	QA/QC water						X	X	SW-18		
PG-22	QA/QC water						X	X			X
PG-23	QA/QC water						X	X			X
PG-24	QA/QC water						X	X			X
PG-25	QA/QC water						X	X			X

Table V - Target Compound List
Animas River Targeting Project
Cement Creek Watershed

MATRIX	ANALYSIS (method)	DETECTION LIMITS ug/l	PRECISION %
Water	Aluminum, EPA 200.7	50	10
Water	Arsenic, EPA 206.4	60	10
Water	Antimony, EPA 200.2	10	10
Water	Barium, EPA 200.7	200	10
Water	Beryllium, EPA 200.7	5	10
Water	Cadmium, EPA 213.2	0.3	10
Water	Calcium, EPA 200.7	1,000	10
Water	Chromium, EPA 200.7	10	10
Water	Chloride, EPA 300.0	1,000	10
Water	Copper, EPA 200.7	4	10
Water	Cobalt, EPA 200.7	50	10
Water	Cyanide	10	10
Water	Iron, EPA 200.7	10	10
Water	Lead, EPA 239.2	5	10
Water	Magnesium, EPA 200.7	1,000	10
Water	Manganese, EPA 200.7	4	10
Water	Mercury, EPA 245.1	0.2	10
Water	Nickel, EPA 200.7	20	10
Water	Nitrate/Nitrite, EPA353.2	500	10
Water	Phosphorus, EPA 365.2	5	10
Water	Potassium, EPA 200.7	0.8	10
Water	Selenium, EPA 270.3	1	10
Water	Silica,	1,000	10
Water	Silver, EPA 272.2	0.2	10
Water	Sodium, EPA 200.7	1,000	10
Water	Sulfate, EPA 300.0	5	10
Water	Thallium, EPA 200.7	10	10
Water	Vanadium, EPA 200.7	50	10
Water	Zinc, EPA 200.7	8	10

TABLE VI
SAMPLE PRESERVATION AND BOTTLE REQUIREMENTS
Animas River Targeting Project
Cement Creek Watershed

AQUEOUS SAMPLES (56 surface water locations, 19 aqueous source samples and 12 QA/QC samples)

Analysis	Samples	Container/Collection /Preservation
Total Metals	All 87	(1) 250 ml poly/2m/HNO3
Dissolved Metals	All 87	(1) 250 ml poly/Field Filter/1m/HNO3
Anions/Cations	All 87	(1) 250 ml poly/neutral

*All samples will be cooled to 4° C upon collection.